



Playing Surface Options for Duvall Field

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Introduction



- Problem?
 - Increased field use
 - Field renovation needs

...so → **Artificial Turf** considerations.

- This comes with controversy

- For Duvall?
 - Artificial Field
 - ...or...
 - Natural Grass
 - Native soil?
 - Modified soil?



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Background



- Playing field surfaces have become a controversial topic, sparking class action suits from local governments and protests from upset constituents
- This controversy has created a difficult decision for universities, recreation centers, and other municipalities in regards to what playing surface type should be installed for field renovations and developments.
 - Controversies include
 - Worries that artificial turf will pose a threat to the health of youth players
 - Concerns about the installation and maintenance costs of artificial turf
- Considerations: player safety, construction and maintenance costs, field use, and environmental concerns

Current State of Duvall Field



- Field use (*highest foot traffic in spring*):
 - Boys and girls clubs
 - Community members
 - Recreational teams
 - Recess
 - 770 hrs/year used for sports; 250 hrs/year for recess
- A minimally maintained field
 - Bermudagrass
- Poor drainage properties:
 - Compaction: High
 - Clay content: 30%
 - Hydraulic Conductivity: $\frac{1}{3}$ in/hr





Project Goals and Research Question

- 1) To provide a comprehensive evaluation of recreational field options :
 - native-soil natural grass field,
 - a modified-soil natural grass field,
 - and synthetic infill field.
- 1) Score matrix that will guide decision making processes
- 2) Brochure to inform communities

What are the pros/cons of each field type relative to the renovation of Duvall Field?

Methodology



Literature Review:

- Databases (Google Scholar, Web of Science, Academic Search Complete)
- Field expert interviews
- Industry professionals/ trade-specific publications

Cost Analysis:

- Values gathered from interview with head of maintenance of University of Maryland, Sport Fields Manual, and Montgomery Parks Service
- Normalized to the year 2019

Matrix:

- Ranking the fields from 1-3 (best-worst) on the most salient factors considered in decision making
 - The three field types were carefully evaluated for each category, and compared against one another



Findings/Results



- History and Evolution of Natural Grass, Modified/ Engineered, and Synthetic Fields
- Player Safety
- Environmental Concerns
- Cost Comparisons

A close-up photograph of a dense field of green grass, showing individual blades in sharp focus against a blurred background.

History and Evolution of Field Options



Natural Grass Field

- Traditionally, athletic fields constructed at the high school, club, and small community levels, have been natural grass because of the low initial establishment cost
- Soil on natural grass fields must be maintained with aeration in order to grow healthy grass
- Good drainage is necessary

Enhanced Drainage Mechanism

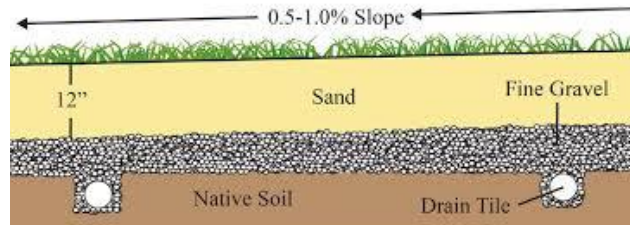
- **Core aeration**
 - Machine with hollow tines mechanically removes plugs or "cores" of soil
- **Sand top dressing**
 - Usually applied after aerating, the **sand** fills in the holes
- **Soil sand cap**
 - Small layer of topsoil is removed and replaced with sand
 - Over time, this can alter the structure of the soil to allow for better drainage and a healthier grass



Source: Hudson Incorporated

Modified/Engineered Field

- Natural grass fields with modified/engineered soils: fields that are mixed with another material (sand) along with natural soil
- Coarser textured soils provided drainage of excess water
 - Promotes healthy turfgrass growth
 - Players can keep playing even after a rainstorm
- First pioneered in 1960 in the United States by the U.S. Golf Association (USGA)
- More popular systems for playing fields include the Prescription Athletic Turf (PAT) System
 - Developed in 1971
 - Substantially reduces maintenance
 - Uses an underground system of vacuums, moisture sensors and drain pipes



Artificial Field Generations 1 & 2

Generation 1

- Tightly curled nylon fiber, woven into a foam backing
- Abrasive, loosely packed tufts
 - Grass carpet over concrete

Generation 2

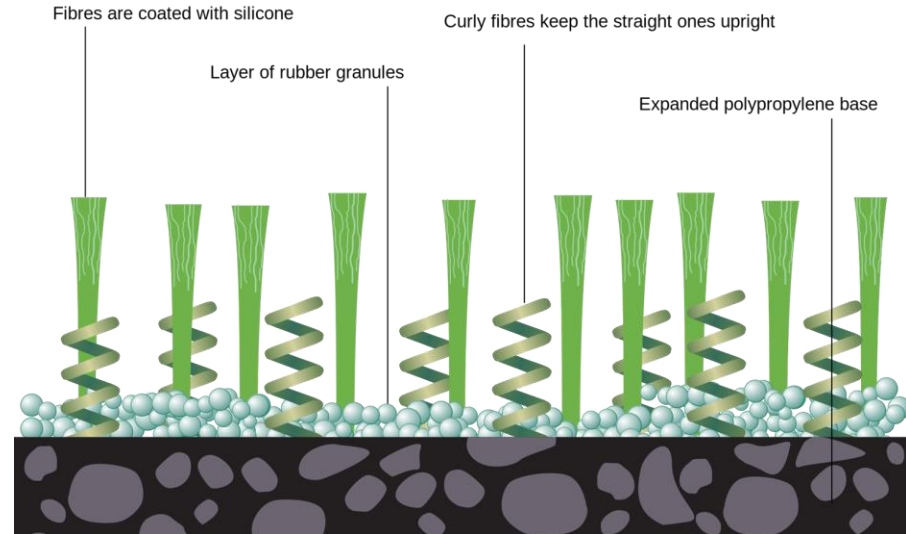
- Longer tufts and sand
- A shock-absorbing pad installed
- Even though strides were made, the field still could not compete with natural grass.
- The carpet pile filled with silica sand within several millimeters of the top of the fibers, allowing them to stand upright



Artificial Field Generation 3



- The grass “blades” are longer and are spaced far apart
- The fibers are made of polyethylene
 - softer and kinder to the skin
- Feature mixtures of sand and rubber granules
 - Stability
 - Ball control



Artificial Field Drainage



- Artificial turf fields are intentionally designed to maximize drainage:
 - Perforated “grassed” carpet
 - Layers of coarse rocks and geotextiles
 - Perforated pipe that directs saturation to storm drains or collectors



Source: Sports Pitch
Construction 2019



Player Safety

<https://www.howstuffworks.com/is-artificial-turf-lawn-future.htm>

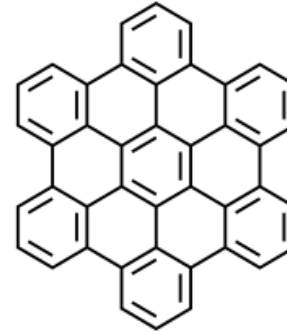
Risk of Joint/Bone Injury

- Artificial turf presents a unique set of injuries that do not tend to happen on natural grass
 - Turf toe
 - Various ankle injuries
 - Concussions



Contaminant Exposure

- Positive correlation between number of artificial turf fields and occurrence of lymphoma in youth sports players that use those fields
- Players are at risk of inhaling chemicals while playing on artificial turf fields (Mechini, 2011)
 - A high concentration of inhalable chemicals were found on fields-negligible increased risk of cancer



Direct Material Contact

- Natural grass can give players “grass rash” also known as “allergic contact dermatitis from grass”
- A survey of 20 U.S. turf field found that there were less microbes on the artificial surfaces in comparison to the natural grass fields
- Artificial turf is more prone to cause friction-based skin abrasions



Direct Material Contact from Heat

- An artificial turf surface can reach up to 170 degree F on an 80 degree F sunny day
- Symptoms from heat stroke/exhaustion occur once the body reaches 104 degree F
 - Skin burns at this temperature as well

Parking Lot : 140 F

Synthetic Field : 157 F

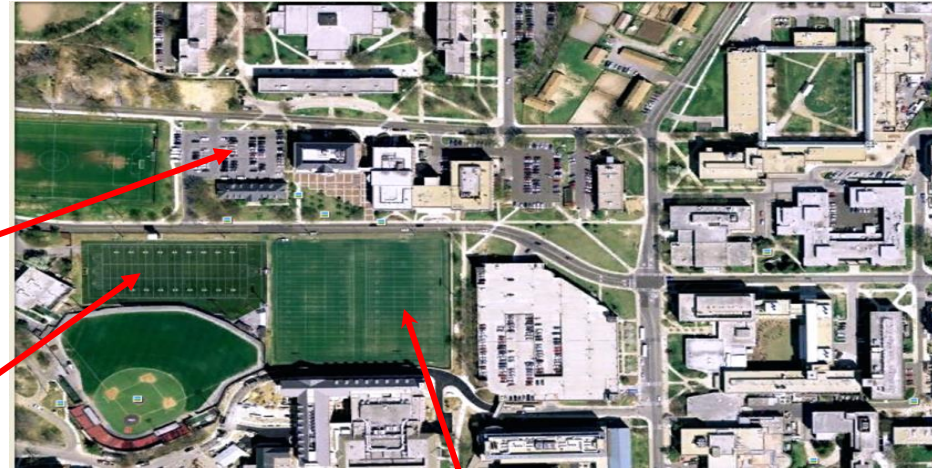


Photo taken on July
6, 2010 at 4:00 pm.
Temperature
was 100 F

Natural fields (Bermudagrass): 94 F

Recent NIH NTP Reports

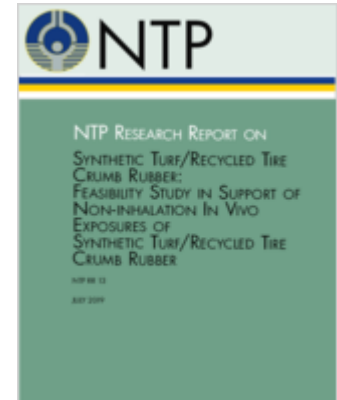
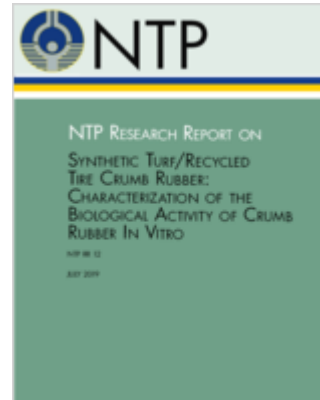
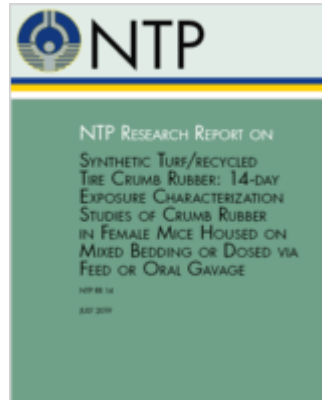
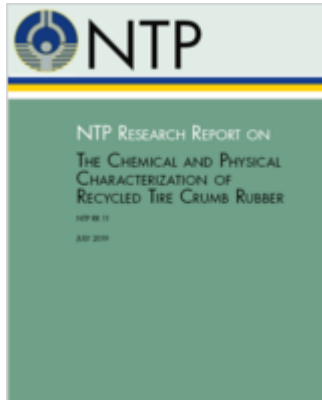


What is NIH NTP?

- National Toxicology Program (NTP)
- National Institute of Environmental Health Sciences (NIEHS)

Series of reports published in July 2019

- 5 years of research
- Overlap between Player Safety and Environmental Health



Recent NIH NTP Reports

How is this relevant to Duvall Field?

- Laboratory Studies
- systemic exposure and bioaccessibility of synthetic turf
- In vivo and in vitro

Results:

- Cytotoxicity observed in skin, lung, and intestinal cells
- No effects in vivo

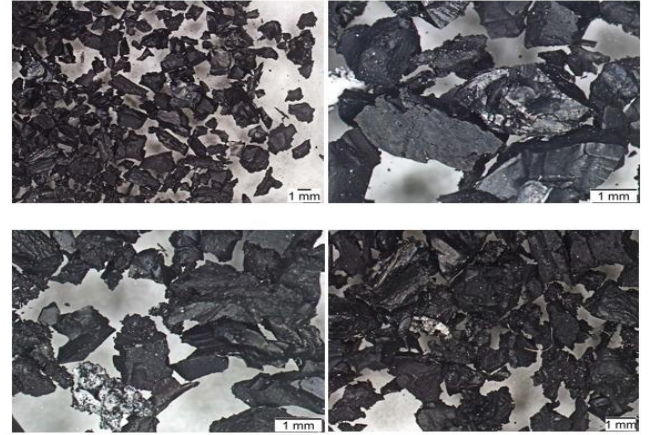


Fig. 1 NTP Research Report on the Chemical and Physical Characterization of Recycled Tire Crumb Rubber: Research Report 11

A close-up photograph of artificial green grass, showing individual blades of grass in sharp focus, creating a dense, textured background.

Environmental Concerns

Natural Grass Field Environmental Concerns:

...For both Native and Modified Soil



- Pesticide and fertilizer use:
 - Potential mobilization of pollutants and nutrients into the surrounding ecosystem
- Higher water consumption for irrigation
 - ...in comparison to artificial turf
 - Modified Soil = highest irrigation needs (more than native soil)



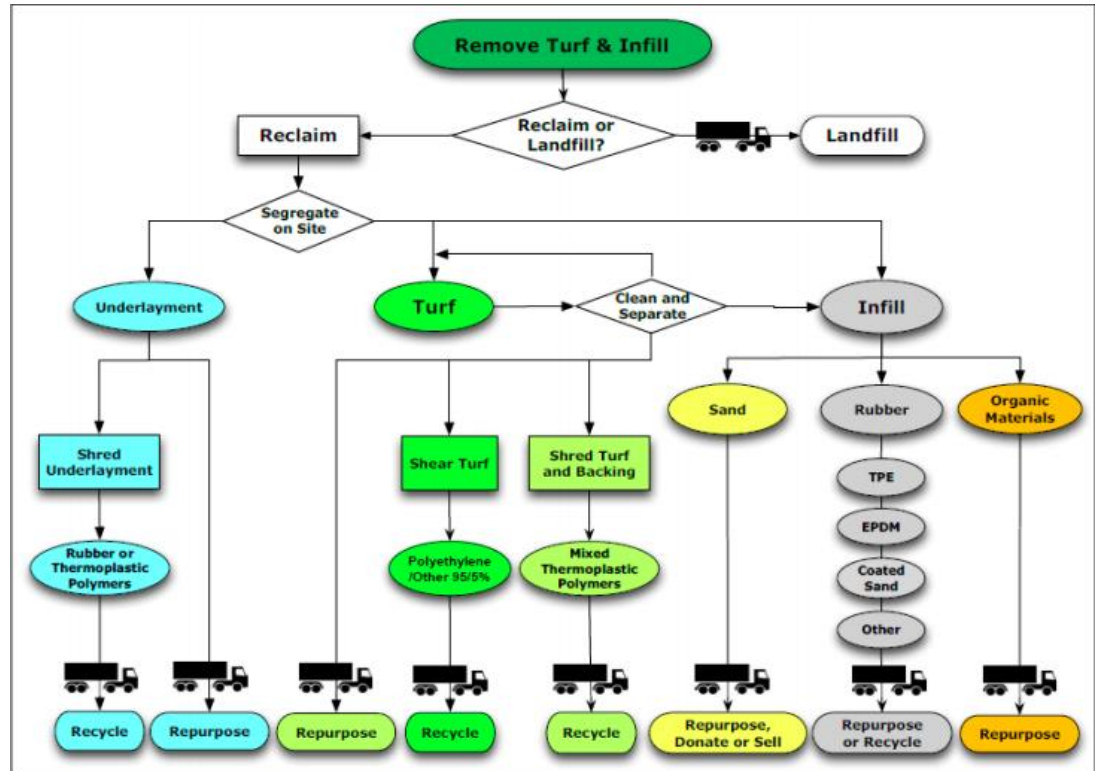
Artificial Field Environmental Concerns

- Water:
 - Conservation of water
 - Reduces mobilization of pollutants
 - Leaching of contaminants (if not collected and treated)
- Air:
 - Volatilization of organic contaminants
- Wildlife:
 - Deterrence
 - Toxicity



Disposal

- Lifespan: 10 years
- Components are becoming more recyclable
 - Crumb rubber
 - Carpet



Source: "Removal, Recovery, Reuse and Recycling of Synthetic Turf and Its System Components." Synthetic Turf Council. January 2013.

Cost Comparison

	Natural	Modified	Synthetic
Installation Cost (STMA) (Based on high school football field size- 57,600 sq. ft.)	Low~ \$34,560 High~ \$172,800	Low~\$158,400 High~ \$230,400	Low~ \$345,600 High~ \$590,400
Maintenance Cost (STMA) (Yearly amount based on Duvall Field's estimated 770 hours of use per year)	Low~ \$39,000 High~ \$58,800	Low~ \$50,000 High~ \$92,500	Low~ \$5,000 High~ \$8,000
Replacement Cost (MGPS) (Every 10 years)	~\$50,000	~\$80,000	~\$640,000

References:

Montgomery County Public Schools. (2011). A Review of Benefits and Issues Associated with Natural Grass and Artificial Turf Rectangular Stadium Fields

Sports Turf Managers Association. (2019). SYNTHETIC TURF OR NATURAL GRASS SPORTS FIELDS?

Field Comparison Matrix

1= Best rating

3= Worst rating

Ex:

1- lowest risk of player injury

3- highest risk

Green - Environmental

Red - Player Health

Blue - Practicality

Factors	Native	Modified	Synthetic
Risk of Player Injury	2	1	3
Direct Material Contact to Players	1	2	3
Contaminant Exposure to Players	1	2	3
Chemical Treatments	2	3	1
Land Disturbance	1	2	3
Wildlife Impacts	1	2	3
Disposal Methods	1	2	3
Drainage	3	2	1
Adaptability	3	2	1
Installation Costs	1	2	3
Maintenance Costs	3	2	1
Durability/ Longevity	3	2	1
Lifespan	1	2	3

Summary of Advantages



Artificial Field:

- Low chemical treatments
- Maximizes field use and play (best drainage, best adaptability, and durability)
- Low maintenance costs

Native Field:

- Lowest direct material contact and contaminant exposure with players
- Lowest environmental disturbance (disposal, land disturbance, wildlife impacts)
- Lowest installation cost
- Longest lifespan

Modified/Engineered Field:

- Lowest risk of joint injury
- Overall, an Intermediary of player health, environmental concerns, practicality, and maintenance and installation costs

Final Considerations



- Duvall Field is to be used mostly by children in a recreational manner
- The playing surface chosen should:
 - Be cool enough to prevent heat related illnesses
 - Be durable enough to handle the wear/tear of children
 - Have the proper drainage mechanisms to allow for it to be played on during the rainy season
 - Non-toxic materials (in the case of accidental consumption by child athletes)
 - Be cost-effective



Questions?



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